

REMARKS

Claims 1-20 are pending in the present application. Claims 12-20 are withdrawn from consideration. Claims 1-11 are rejected. Claims 1 and 10 are herein amended. No new matter has been entered.

Claim Rejection – 35 U.S.C. 112

Claim 10 is amended so that the conductor device includes a plurality of second inter-layer insulation films each including a diffusion preventing film and a second low dielectric constant film. Claim 10 defines the relationship in the layered structure between the diffusion preventing film of one second inter-layer insulation film and the second low dielectric constant film of another second inter-layer insulation film.

Applicants submit that the amended claim 10 is sufficiently definite to overcome the rejection.

Claim Rejections – 35 U.S.C. §103(a)

Claims 1, 3, 5, 8, and 10 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Miyamoto et al. (US Patent No. 6,670,714)* in view of *Chiang et al. (U.S. 5,739,579)*.

Applicants herein amend claims 1 and 10. Thereafter, Applicants respectfully disagree with the rejection because not all of the claimed limitations are met by the cited combination of references.

Applicants note that the invention according to claim 1, as herein amended, includes an insulation film formed on a low dielectric constant film is varied according to a pitch of an interconnection layer which is buried in the low dielectric constant film. That is, a hydrophilic insulation film is formed on a first low dielectric constant film in which a first interconnection layer having a smaller minimum pitch is buried, while a diffusion preventing film is formed directly on a second low dielectric constant film in which a second interconnection layer having a larger minimum pitch is buried. By selectively using the hydrophilic insulation film or the diffusion preventing film according to the pitches of the interconnection layers, in a case that low dielectric constant films are used as inter-layer insulation films, the first interconnection layer can suppress the occurrence of defects and the decreases the interconnection capacitance, while the second interconnection layer can sufficiently decrease the interconnection capacitance, corresponding to functions of the interconnections.

On the other hand, the cited references *Miyamoto et al.* and *Chiang et al.* neither disclose nor suggest the limitation of the present invention that either a hydrophilic insulation film or a diffusion preventing film is formed in a low dielectric constant film according to a pitch of an interconnection layer that is buried in the low dielectric constant film. Applicants note that *Miyamoto et al.* only discloses a structure of a multi-layer interconnection, never disclosing nor suggesting the relationship between the pitches of interconnections and physical properties or materials of the inter-layer insulation films. Further, *Chiang et al.* discloses a simple layered structure of a silicon oxide layer and a silicon nitride layer. It is apparent that *Chiang et al.* never discloses nor suggests choice of a hydrophilic insulation film and a diffusion preventing film

according to a pitch of an interconnection layer. Therefore, even the properly combined teachings of *Miyamoto et al.* and *Chang et al.* cannot lead to the essence of the present invention.

The Examiner asserts that a silicon oxide layer disclosed in *Chiang et al.* is regarded as a low dielectric constant film of the present invention. However, when the term “low dielectric constant (low-k) film” is used in the technical field of the inter-layer insulation film of semiconductor devices, it is usual that the term “low dielectric constant (low-k) film” represents a film whose dielectric constant is lower than that of a silicon oxide. The first and second low dielectric constant films of the present invention also indicate insulation films whose dielectric constants are lower than that of silicon oxide. The amended claims 1 and 10 explicitly state this matter regarding the dielectric constants of the first and the second dielectric constant films. *Chiang et al.* does not teach such a low dielectric constant film whose dielectric constant is lower than that of a silicon oxide, but only teaches a silicon oxide layer.

Furthermore, Applicants note that it is known that a silicon nitride film, which is included in an inter-layer insulation film of a semiconductor device, is not hydrophilic but water-repellent. *Chiang et al.* does not show nor imply any special treatment or others to make such a water-repellent silicon oxide film hydrophilic. Accordingly, the silicon nitride film disclosed in *Chiang et al.* cannot correspond to the hydrophilic insulation film of the present invention.

Therefore, the combined structure of *Miyamoto et al.* and *Chiang et al.* does not teach a low dielectric constant film and a diffusion preventing film formed directly on the low dielectric constant film. The combined structure of *Miyamoto et al.* and *Chiang et al.* never provides a low

dielectric constant film and a hydrophilic insulation film formed on the low dielectric constant film.

As discussed above, the combined structure of *Miyamoto et al.* and *Chiang et al.* do not provide the layered structure of the first low dielectric constant film and the hydrophilic insulation film and the layered structure of the second low dielectric constant film and the diffusion preventing film of the present invention. Therefore, it is clear that the present invention according to claims 1, 10 and dependent claims 3, 5, and 8 would have been unobvious to one of ordinary skill in the art at the time the invention was made.

Claims 2, 4, 6, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Miyamoto et al.*, *Chiang et al.* in view of *Kajita* (US Patent No. 6,573,604). Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Miyamoto et al.*, *Chiang et al* in view of *Ong* (U.S. Pub. No. 2004/0104481 A1).

As described above, even if *Miyamoto et al.* were combined with *Chiang et al.*, it is clear that the present invention according to claims 1 and 10 would have been unobvious to one of ordinary skill in the art at the time the invention was made. Therefore, even *Miyamoto et al.* and *Chiang et al.* were further combined with *Kajita* or *Ong*, it is clear that the present invention according to claims 2, 4, 6, 7, and 11 dependent directly or indirectly from claim 1 or 10 would have been unobvious to one of ordinary skill in the art at the time the invention was made.

Application No. 10/816,955
Attorney Docket No. 042322

Amendment under 37 C.F.R. §1.111

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

Application No. 10/816,955
Attorney Docket No. 042322

Amendment under 37 C.F.R. §1.111

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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